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54 Meat processor and process for treating meat.

57 A meat processor having a refrigerated drum (11) under a vacuum which simultaneously shakes while it rotates about an axis (13) perpendicular to its longitudinal axis.

A process for treating meat to raise myosin protein to the surface of the meat and to increase the absorption of fluid or additives by first crushing or mashing the meat and then simultaneously shaking and tumbling the meat while it is refrigerated and under a vacuum.

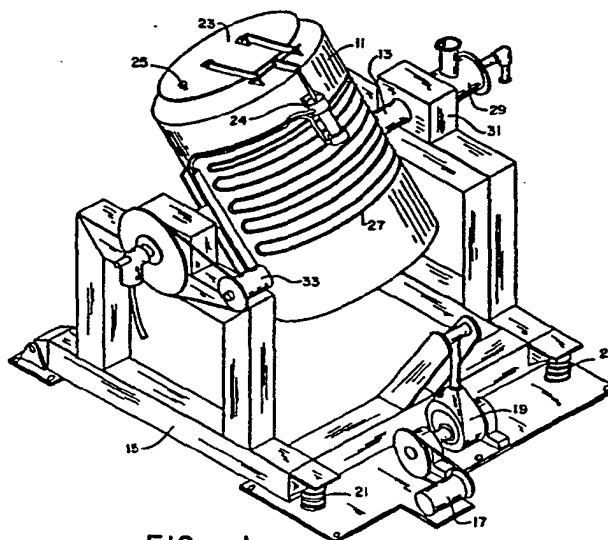


FIG. — I

EP 0 053 781 A1

1 TITLE OF THE INVENTION

A Meat Processor and Process for Treating Meat

BACKGROUND OF THE INVENTION

5 FIELD OF THE INVENTION

The present invention relates to meat processors and a process for treating meat. More particularly it relates to a meat shaker and tumbler and a process for bringing myosin and other proteins to the surface of the meat and for effecting better distribution, retention, and absorption of the fluids, brine, pickle, or additives in the meat by simultaneously shaking and tumbling the meat while it is under a vacuum and refrigerated.

15 DESCRIPTION OF THE PRIOR ART

It has been known for several years that if the myosin and other proteins found in meat can be brought to the surface of the meat, the adhesive qualities of the proteins will bind individual meat pieces during cooking into a solid whole piece of meat. This improves the appearance of the meat for presentation to the market. There have been many machines designed to release the myosin proteins by abrading or cutting the surface of the meat, and these machines extract the proteins in a relatively short period of time. However, they are very crude and have a destructive effect on the meat and its resulting appearance. They also reduce the meat's capability of absorbing injected pickle or retaining its juices. These prior art machines are also often dangerous to operate and require considerable hand labor in processing the individual meat pieces through the machines.

Another method of extracting myosin proteins from cured meats, such as ham, involves tumbling the meat in large rotatable drums, called tumblers. The drum is usually

-2-

1 provided with internal radially projecting baffles or
paddles affixed longitudinally to the internal wall and
sometimes to the end of the drum. The drum is then rotated
on its cylindrical axis which is disposed during rotation at
5 an angle somewhere between horizontal and substantially less
than vertical. During rotation, the internal baffles move
those portions of the meat which are at the bottom of the
drum out from under the stack of meat. They lift the meat
up the side of the drum then drop it back into the mass of
10 meat. The action is very much like a powered cement mixer.

While this latter tumbling process is effective, and
can be used for large quantities of meat without hand
processing, it is a very slow process and may take from six
to eighteen hours with the machinery of the prior art to
15 effect the proper myosin release. In addition, the internal
baffles tear and cut the pieces of meat, which are pulled
out from under the stack, and all of the pieces of meat are
repeatedly subjected to this tearing because of the long
treatment time. The result is that this type of tumbler can
20 only be used where the appearance of the meat pieces is not
important in the final product. Delicate meat pieces, such
as bone-in hams, poultry, water-added boneless hams, and
other water-added products cannot be tumbled in these large
drums successfully. The tumbling process destroys the
25 appearance and unity of the pieces of meat thereby adversely
effecting the yield and quality of the product.

Even for those types of meat which can be tumbled in
the prior art machines, the action is very slow, and a large
number of tumblers are required to process a large volume of
30 meat which thus results in a large capital outlay for a
processing line and higher prices for the end product.

-3-

1 It is known that tumbling process time can be reduced
by placing the meat under a vacuum while it is being tumbled.
Thus, some of the tumblers on the market are sealed to
permit a vacuum to be established in the container so the
5 meat is tumbled in a partial vacuum. The problems of the
tearing of the meat and of lower yields are not solved by
such machines, however.

 The present invention has been found to greatly reduce
the processing time for extracting myosin and other proteins
10 to the surface of the meat from the six to eighteen hours of
the prior art to times of less than an hour. This time
savings results in a tremendous increase in production
volume per machine which effects a savings in capital outlay
and results in reduced prices of the end product. This time
15 savings is achieved by simultaneously tumbling the meat,
with a different motion or action than has been predominately
used by the prior art, and shaking the meat.

 In the present invention, as a result of the unique
tumbling motion, all of the meat in the drum is also subjected
20 to large pressure changes which greatly reduce the processing
time as the drum is rotated. All of the meat rolls over and
moves from the top of the pile of meat to the bottom while
being shook but without tearing or pulling. Each piece of
meat is mashed and crushed by this action rather than being
25 torn out from under the pile by baffles and lifted and
dropped on top of the pile. The effect is to massage the
meat rather than to tear, batter, and abuse it. Thus,
because the present invention does not tear or cut meat
pieces, even delicate pieces of meat that previously could
30 not be quickly processed, or could not be processed at all
by the prior art machinery, can now be tumbled for extraction
of myosin proteins.

-4-

1 It appears that the combined massaging and shaking
action of the present invention on the meat causes greater
absorption and retention of the protein juices, brine,
5 pickle, or additives in the meat which results in a more
nutritious product as well as a higher yield. This means
that soluble proteins which would otherwise drain out of the
meat with lost pickle can be more completely retained. In
addition, shaking the meat under a refrigerated vacuum while
10 tumbling it contributes to a further reduction in the
processing time. It is believed that the combination of
massage tumbling and the simultaneous shaking action pro-
duces the enhanced processing effects of the present in-
vention.

15 SUMMARY OF THE INVENTION

 The present invention is a meat processor which in-
cludes a drum arranged to rotate about an axis perpendicular
to its longitudinal axis. Means are also provided for
shaking the drum while it rotates, and for refrigerating and
20 evacuating the drum. In addition, the drum includes a
removable insert which can work the meat to further increase
the rate of protein extraction. The present invention also
includes a process for treating meat to raise myosin proteins
to the surface of the meat and to increase fluid and additive
25 retention by the meat by simultaneously shaking the meat
while tumbling it in a meat processor as described herein so
that the meat pieces tumble over themselves and are alternately
compressed and relieved while being continuously shook. The
process is enhanced by keeping the meat refrigerated and
30 under a vacuum during the tumbling and shaking and is further
enhanced for less delicate pieces of meat by mashing, crushing
or puncturing them prior to the shaking-tumbling step.

1 OBJECTS OF THE INVENTION

 It is an important object of the present invention to provide a meat processor which tumbles the meat being processed and alternately moves it from the top of a pile of
5 meat to the bottom, without cutting or tearing the individual meat pieces, so that the meat is massaged.

 It is also an important object of the present invention to provide a process for raising myosin or other proteins to the surface of the meat with a minimum of cutting or tearing
10 of the meat during the process in order to keep the meat pieces whole and their appearance intact.

 It is another object of the present invention to provide a meat processor which shakes the meat while it is being tumbled.

15 It is a further object of the present invention to keep the meat under a refrigerated vacuum while it is being shook and tumbled.

 It is still another object of the present invention to provide a machine and a process which greatly reduces the
20 time necessary to bring myosin or other proteins to the surface of the meat being processed.

 It is still a further object of the present invention to provide a meat tumbler and a process which can be utilized to treat a wide variety of meats including delicate pieces
25 of meat such as bone-in hams, bacon bellies, pork loins, picnic and poultry pieces, and water-added meat products.

 It is yet another object of the present invention to provide a meat processor and a process which causes a faster and more complete absorption of brine, pickle, or other
30 additives and fluids into meat, and stabilization of the same in the meat, for higher quality and yield.

 And it is yet a further object of the present invention to provide a meat processor which can be adjusted to process less delicate meats by increasing the working of the meat

-6-

1 while it is in the processor to further reduce the time for
extracting the myosin or other proteins.

Other objects of the present invention will become
apparent when the description of the preferred embodiment
5 described hereinafter is considered in light of the prior
art and in conjunction with the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a perspective view of the meat tumbler of the
10 present invention; and

FIG. 2 is a perspective view of an insert for the drum
thereof.

DESCRIPTION OF THE PREFERRED EMBODIMENT

15 In the meat processor of the present invention, a drum
11 is provided which is arranged to rotate about an axis 13
perpendicular to its longitudinal axis. The drum could of
course be of equal length and width and depth so that there
is no one axis longer than any other and any axis could be
20 the longitudinal axis. The drum can be any configuration
but a cylindrical shape is preferred for ease of manufacture
and cost effectiveness. In any drum that has a longitudinal
axis, one longer than the other, the preferred method is to
rotate it about the longer axis although rotation along the
25 other axis would also serve the purpose but less efficiently.
The reason the most efficient action appears to be obtained
from rotating the drum perpendicular to its longitudinal
axis is that this orientation creates the largest distance
for the meat to fall during rotation and accordingly, the
30 greatest massaging pressures on the meat in the drum.

The drum 11 is preferably smooth walled internally so
that it does not catch or tear the meat in any way. The
drum is preferably operated at about three-fourths full so
that when the meat slides from end to end as the drum
35 rotates, it also tumbles over the other pieces and each

1 piece changes position from the top of the pile to the
bottom due to the tumbling action. The action alternately
mashes the meat piece and then relieves the pressure on each
meat piece being rolled over internally in the drum. As the
5 meat piece moves from the top of the pile of meat to the
bottom the meat is continually cycled from a low pressure
environment at the top to a high pressure constriction under
the load of meat.

The drum 11 rotates fairly slowly with a preferred
10 rotation rate of between one (1) and twenty-five (25) rpm.
The large size drums, which are considered optimum at the
present time, have approximately a 2000 pound (907.2 kg)
capacity when three-quarters full. Between five (5) and
sixteen (16) rpm seems to be the optimum rotation rate
15 within the preferred speed range.

Means are provided for shaking the drum while it
rotates. This is done by supporting the drum on a frame 15
and having the frame arranged so that at least part of it
can be reciprocated in a cycle for a predetermined distance
20 and at a rate which will effect the means for shaking the
drum. In the present invention, the frame is arranged to
pivot at one end about a horizontal axis so that the other
end can be moved up and down. A means 19 is provided for
reciprocating the movable end of the frame up and down
25 through a variable distance of between 1/4 and 2 inches
(0.635 and 5.08 cm) at a controllable rate with the range
between 1/2 and 1-1/2 inches (1.27 and 3.81 cm) apparently
the optimum. This is done by a motor 17 which is connected
to the movable portion of the frame through an adjustable
30 throw crank shaft 19. This mechanical arrangement causes
rythmic shaking to occur. Springs 21 are mounted under the
moveable end of the frame to help support the weight of the
drum 11 and to reduce the power requirements necessary to
effect the shaking. Variable pressure airbags can be used
35 to assist the springs to compensate for different weight

-8-

1 loads in the tumbler. The rate of shaking of the drum,
which seems to be most effective, is between 25 and 800
cycles per minute with the most effective shaking for most
meats occurring in the cycle range of 100 to 300 cycles per
5 minute. The rate varies with different types of meat. More
delicate meats have to be tumbled and shook slower.

A means is provided for evacuating the unoccupied
interior space of the drum 11 after it has been filled to
its operating volume with the meat to be processed. This is
10 most easily done by making the cover 23, which is removable
or openable, air-tight. Because of the elevated location of
the cover when the tumbler is upright, the opening and
closing of the cover can be actuated by an air cylinder 24.

A vacuum connection 25 is mounted to the drum 11 to
15 permit a vacuum to be pulled on the drum after the drum has
been filled to its operating capacity with meat. This
effects the evacuation of most of the air from the unoccupied
interior space of the drum. For ease of manufacture, the
vacuum connection is made integral to the cover 23 of the
20 drum.

A means is also provided for refrigerating the meat
being processed while it is in the drum 11. This is done by
providing refrigerating coils 27 which are secured to the
drum. The coils are fed through rotatable connections 29
25 which are standard items. These rotatable connections are
integral to the rotatable journals 31 mounted on the frame
15 and supporting the drum. Refrigerating the meat retards
bacterial growth, counteracts heat buildup from the interaction
of the meat pieces, and stimulates extraction of the myosin
30 or other proteins.

A motor 33 is provided for rotating the drum 11. In
the preferred embodiment, both the drum drive motor 33, for
rotating the drum, and the crank shaft drive motor 17, for

1 shaking the drum, are variable speed hydraulic drive. The
variable speed can be controlled by an operator during
operation.

5 The process of the present invention is most beneficially
utilized on meats which have been pickled and are to be
cured and cooked or smoked or frozen. After the meat pieces
have been injected with pickle, the usual process is to
allow them to stand approximately twelve (12) hours to
permit the pickle to be absorbed into the meat tissue.

10 Allowing meat to stand after it has been injected with
pickle makes it relatively stiff due to advanced rigor
mortis. This stiffness makes the meat more difficult to
process, and it therefore takes the prior art tumblers
longer to raise the myosin proteins because of the stiff
15 rigor mortis condition.

If the meat pieces are processed by the cutting, macerating,
or tumbling processes of the prior art before being allowed
to stand the full twelve hours, the tearing of the meat
causes it to lose a portion of the pickle and meat juices
20 which results in lower quality and product yield.

The process of the present invention permits pickled
meat to be processed much sooner after the pickle has been
injected because the process of the invention is much less
destructive of the fluid retention capability of the meat so
25 that it does not lose pickle and meat juices. The process
actually treats the meat to enhance its fluid retention
capacity while activating the protein release mechanism in
the meat.

Although the main characteristic of the process of the
30 present invention is the unique combined tumbling and
shaking action described herein, the process of the present
invention may also include a prior processing step which
greatly enhances fluid retention and the myosin extraction

1 process. However, this step can only be utilized on the
less delicate meat products where the appearance of the
product is unimportant or the effects are not visible in the
final product. The prestep includes passing the meat pieces
5 through a mashing and puncturing device which crushes the
meat under a roller to make it pliable and to burst and
rupture the internal cells of the meat pieces. The mashing
action of the roller breaks down the rigor mortis of the
meat as well as causing greater absorption and retention of
10 the injected pickle internally of the meat while at the same
time producing an increased release of myosin proteins from
those internal cells for extraction to the surface.

The masher used for the prestep includes a roller
having sharp radial projections formed on it. When the meat
15 is run under the roller, the roller punctures and crushes
and mashes the meat against a spring loaded plate which
evenly distributes the pressure of the roller on the meat
irrespective of the varying thicknesses of the pieces of
meat. Other methods of mashing, such as by passing the meat
20 between a pair of opposed rollers may also be effective.

In the preferred embodiment of the process of the
present invention, the meat is fed through the masher with
the smooth external surface of the meat held intact by the
pressure plate while the internal exposed surface of the
25 piece of meat, created by the removal of the bone, is
crushed by the projections of the roller. These projections
are intended to puncture the surface of the meat and crush
and mash the internal fiber and cells.

The pieces of meat are preferably subjected to successive
30 steps of less severe mashing rather than one heavy step.
This less severe mashing can be accomplished by placing two
machines in tandem with a lighter pressure setting on the
pressure plate and then simply running the meat through the
two machines successively. It is believed this prestep
35 makes the meat pliable by breaking up the rigor mortis,

1 distributes the injected pickle evenly throughout the meat,
and releases myosin within the meat so that the main step of
the process is more effective and takes less time to accom-
5 plish its objective of bringing the myosin proteins to the
surface of the meat.

After mashing, the pieces of the meat are placed in the
large meat processing tumblers of the invention which are
described above. The action of these tumblers is to cause
the meat to tumble over itself and cycle from a top portion
10 of the mass of meat in the drum to a bottom portion of the
mass. The meat is simultaneously shaken.

The combined effect of this tumbling and shaking action
is to massage the meat and increase the absorption and
retention of the pickle for higher quality in firmness and
15 color and higher yield weights while at the same time
causing the myosin proteins to be released and extracted to
the surface of the meat. The myosin extraction time is
drastically reduced from hours to minutes and free pickle in
the drums is absorbed into the meat.

20 When the appearance of the meat is not important, a
removable insert or liner 35 is provided for the drum 11
which includes means for working the meat processed in the
drum to further increase the rate of protein extraction. In
a preferred embodiment, the means for working the meat
25 includes a roughened surface inside the liner which abrades
the meat to release the proteins. Sharp internal projections
formed in the insert such as by punching through from the
outside has proved effective and least expensive to form.
The insert is used only where the appearance of the meat is
30 unimportant, such as for a sectioned and formed product, but
where reduced processing time is most important.

The combined action of shaking and tumble massage in
the manner of the present invention has been shown to
decrease the time necessary to bring the myosin proteins to
35 the surface of the meat from the six to eighteen hours of

1 the prior art machines to less than an hour and to a matter
of minutes when combined with refrigerating the meat and
working under a vacuum in the tumbler.

5 The use of the drum insert 35 can further reduce the
processing time when the appearance of the meat is unimportant
to the final product.

Similarly, process time savings and increased fluid
retention and protein extraction can be achieved for less
delicate meats by the prestep of passing the meat pieces
10 through a mashing and puncturing device which first makes
the meat pliable, distributes the pickle evenly throughout
the meat and releases the proteins within the meat.

This decrease in processing time also decreases by a
direct proportion the number of machines necessary for a
15 desired production rate. Therefore it is obvious that the
improvements provided by the present invention are extremely
important to the meat processing industry and will have
significant economic impact in the savings for meat processors.

The shaker-tumbler of the present invention also makes
20 it possible to treat delicate meats for protein extraction
and enhanced fluid retention without adversely affecting the
appearance of the final product.

Additionally it has been found that the process of the
present invention increases the absorption and retention of
25 fluid and additives by the meat. While it is not known why
or how it occurs, it has been found that pickle and meat
juices which have drained out of the meat after the pickle
injection, and which contain valuable proteins, are reabsorbed
back into the meat during tumbling and shaking if they are
30 added to the tumbler along with the meat before processing.
The result is a more nutritious end product, and the process
saves for the consumer valuable proteins which would
otherwise be lost.

1 It will be seen from the foregoing description of the
present invention that it will accomplish all of the objectives
and advantages attributable thereto. While the processor
and process of the present invention have been described in
5 considerable detail, they are not to be limited to such
details except as may be necessitated by the appended
claims.

WE CLAIM:

1 1. A meat processor specially designed for treating a quantity of meat pieces to raise proteins to the surface of the meat and increase fluid and additive absorption comprising

5 a drum (11) arranged to rotate about an axis (13) perpendicular to its longitudinal axis at a rate between one (1) and twenty-five (25) rpm, and

10 means for shaking said drum at a rate between twenty-five (25) and eight hundred (800) cycles per minute.

15 2. The meat processor of claim 1 including a frame (15) supporting said drum (11), said frame being arranged so that at least a part of it can be reciprocated in a cycle at a rate which will effect the means for shaking said drum.

20 3. The meat processor of claim 1 including means for evacuating air from the unoccupied interior space of said drum (11) after it has been filled to its operating volume with meat to be processed.

25 4. The meat processor of claim 1 including means for refrigerating the meat to be processed while it is in the drum.

30 5. The meat processor of claim 1 including a removable insert (35) for said drum (11), said insert including means for working said meat to increase the rate of myosin extraction therefrom.

35 6. A meat processor comprising
a drum (11) mounted on a frame (15) to rotate about an axis (13) perpendicular to its longitudinal axis, said frame being arranged to pivot at one end so that the other end can be moved up and down a predetermined distance which is variable between one-fourth (1/4) and two (2) inches (0.635 and 5.08 cm),

1 means attached to said frame for rotating said drum at
a rate between one (1) and twenty-five (25) revolutions per
minute,

5 means for reciprocating the movable end of said frame
up and down through said predetermined distance at a variable
rate between one hundred (100) and three hundred (300)
cycles per minute, and

10 means for evacuating air from the unoccupied interior
space of said drum after it has been filled to its operating
volume with meat to be processed.

15 7. The meat processor of claim 6 including means for
refrigerating the meat to be processed while it is in the
drum (11).

8. The meat processor of claim 6 including a removable
insert (35) for said drum (11), said insert including means
for working said meat to increase the rate of myosin extraction
therefrom.

20 9. A meat processor comprising
a frame (15) pivoted at one end to permit at least
partial rotation of said frame about a horizontal axis to
permit the remainder of said frame to be cycled up and down,

25 a motor driven adjustable throw crank shaft (19)
connected to a movable portion of said frame and arranged to
cycle it up and down a predetermined distance between one-
half (1/2) and one and one-half (1-1/2) inches (1.27 and
3.81 cm) at a variable rate between one hundred (100) and
30 three hundred (300) cycles per minute,

a drum (11) mounted on said frame and arranged to
rotate about an axis (13) perpendicular to its longitudinal
axis,

- 3 -

- 1 a motor (33) mounted on said frame arranged to rotate
said drum (11) at a rate between five (5) and sixteen (16)
revolutions per minute,
an air-tight cover (23) for said drum (11),
5 a vacuum connection (25) mounted on said drum (11) to
permit a vacuum to be pulled on said drum after it has been
filled to its operating volume with meat to be processed to
permit evacuation of air from the unoccupied interior space
of said drum, and
10 refrigerating coils (27) secured to said drum (11),
said coils being fed through rotatable connections (29)
integral to rotatable journals (31) mounted on said frame
(15) supporting said drum (11).
- 15 10. The meat processor of claim 9 including a removable
insert (35) for said drum (11), said insert including means
for working said meat to increase the rate of myosin extraction
therefrom.
- 20 11. A process for treating a quantity of meat pieces
to raise proteins to the surface of the meat and increase
fluid and additive absorption and retention comprising
simultaneously shaking the meat while tumbling it in a
container (11) which causes the meat to tumble over itself
25 and cycle from a top portion of the mass to a bottom portion
of the mass (without being pulled from the bottom of the
mass with a cement mixer action) whereby the meat pieces are
alternately compressed and relieved while being shook.
- 30 12. The process of claim 11 including pre-treating the
meat pieces to cause the proteins in the meat to be released
and to break up the rigor mortis stiffness of the meat
before shaking and tumbling the pieces.
- 35 13. The process of claim 12 where in the pretreatment
of the meat the meat is subjected to a mashing, crushing, or
puncturing action.

1 14. The process of claim 11 wherein the meat is also
refrigerated while it is being tumbled and shook.

5 15. The process of claim 11 wherein the meat is also
under a vacuum while it is being tumbled and shook.

10 16. A process for treating meat comprising
simultaneously shaking and tumbling the meat pieces in
a relatively smooth walled container (11) which is rotated
about a horizontal axis (13) perpendicular to its longitu-
dinal axis.

15 17. The process of claim 16 including pre-treating the
meat pieces to cause the myosin in the meat to be released
and to break up the rigor mortis stiffness of the meat
before shaking and tumbling the pieces.

20 18. The process of claim 16 wherein the meat is tumbled
at a rate between one (1) and twenty-five (25) revolutions
per minute.

25 19. The process of claim 16 wherein the meat is shook
at a rate between twenty-five (25) and eight hundred (800)
cycles per minute.

 20. The process of claim 16 wherein the meat is also
refrigerated while it is being tumbled and shook.

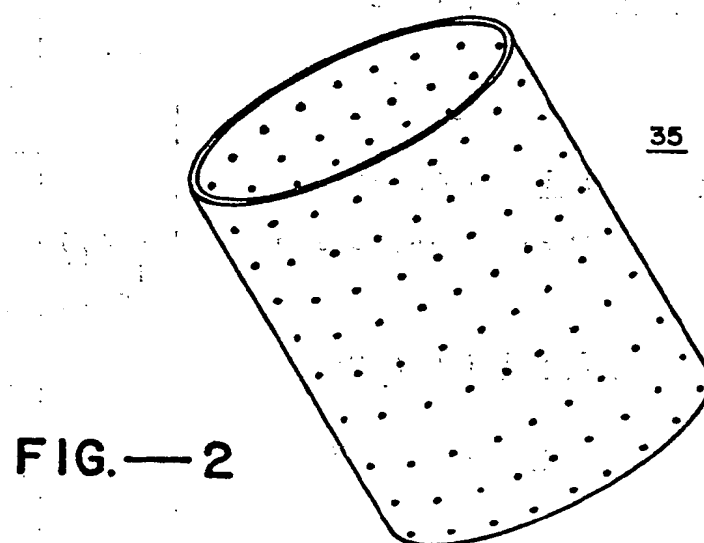
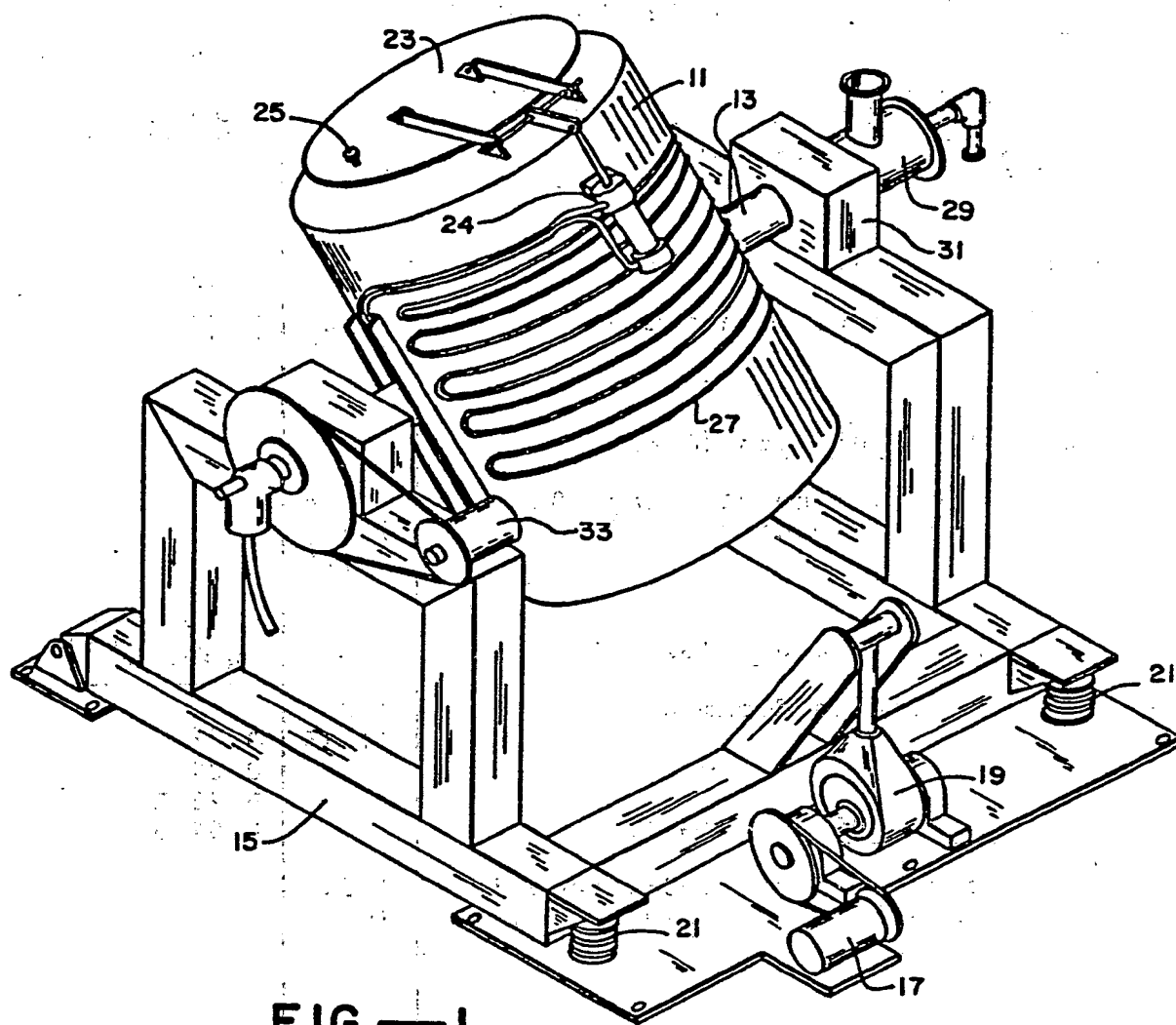
30 21. The process of claim 16 wherein the meat is also
under a vacuum while it is being tumbled and shook.

35 22. A process for treating meat comprising
tumbling the meat in a smooth walled container (11)
which is rotated about a horizontal axis (13) perpendicular
to its longitudinal axis at a rate between five (5) and
sixteen (16) revolutions per minute,

- 1 shaking the meat at a rate between one hundred (100)
and three hundred (300) cycles per minute while it is being
tumbled,
 refrigerating the meat while it is being tumbled and
5 shook,
 performing the tumbling, shaking, and refrigerating
actions while the meat is under a vacuum.

23. The process of claim 22 wherein the meat is first
10 pre-treated by mashing and crushing it between a roller
having a radial projections on its outer surface and an
adjustable spring loaded pressure plate.

24. The process of claim 22 wherein the meat is
15 tumbled in a container having means for additionally working
the meat to more quickly raise the myosin to the surface of
the meat.





European Patent
Office

EUROPEAN SEARCH REPORT

0053781

Application number

EP 81 11 0013

DOCUMENTS CONSIDERED TO BE RELEVANT			CLASSIFICATION OF THE APPLICATION (Int. Cl. 3)
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	
A	US - A - 4 036 122 (LANGEN) * the entire document *	1, 12, 13, 17, 23	A 22 C 9/00 A 23 B 4/00 B 01 F 11/00
A	DE - A - 2 056 048 (JAKA) * page 7, line 24 - page 8, line 19; claims 6, 7 *	1, 3, 4, 7, 14, 15, 20, 21	
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A	EP - A - 0 006 728 (GRACO) * page 7, lines 22-33; page 8, lines 31-35; claims 12, 14, 15, 16 *	1, 6, 19	
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A	US - A - 3 977 876 (MONRICK)		
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<input checked="" type="checkbox"/> The present search report has been drawn up for all claims			&: member of the same patent family, corresponding document
Place of search The Hague		Date of completion of the search 03-03-1982	Examiner DE LAMEILLEURE

